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SOYBEANS

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SOYBEANS

Introduction and summary

Japan is not important as a world producer of soybeans. It is, however, normally the world's principal soybean importer. Its annual production during 1928-39 was only 10 to 14 million bushels. By comparison, the production in the United States was 90 million bushels in 1939 and more than 190 million bushels in 1943 and 1944; the average annual production of soybeans in Manchuria during the thirties was more than 150 million bushels annually.

Prior to the present war Japan took most of the exportable surplus of Manchuria, the principal world exporter of soybeans, as well as substantial quantities from Korea, a country which produces almost twice as many soybeans as does Japan. During the 10 years 1928-37, Japanese imports averaged 26 million bushels annually, approximately double its own production. In 1938 imports increased to 30 million bushels. The value of the imports during 1928-37 averaged over 65 million yen, or about 2.3 percent of the value of all imports into Japan. Exports of soybeans from Japan have been negligible.

Japan's apparent consumption during the period 1928-37 averaged about 38 million bushels or three times production. In 1938 consumption increased to about 43 million bushels, or about 0.6 bushel per capita, which was equal to the per capita consumption in the United States in 1939 but less than one-half that of the United States in 1943 (1.4 bushels).

The production, imports, exports, and apparent consumption (total and per capita) of soybeans in Japan, 1928-39, are shown in table 1.

If an annual per capita consumption of 0.5 bushels of soybeans were to be maintained in Japan in the postwar period, there would be required a total supply of about 37 million bushels of soybeans annually, based on the 1940 population level of 73.1 million (or a total of 38.5 million bushels based on an anticipated population of 77 million in 1947). Probably 10 to 14 million bushels could be produced domestically in the short-term period after the war, depending in part on the fertilizer situation. This would leave a balance of from 23 to 27 million bushels to be imported from abroad.^{1/} Although soybeans are very important to the Japanese as a source of food, the need for soybean imports in the post-war period should

^{1/} On the basis of unit prices of imports in the period 1933-37, imports of 23 million bushels would have been valued at about 65 million yen, and imports of 27 million bushels at about 77 million yen.

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large part as a substitute for the proteins of meat, milk, or eggs. Soybean oil, which is classified as a semidrying oil,^{1/} is adaptable to many uses; in the United States it has for many years been used principally in the manufacture of food products. Soybean cake, the residue after oil is extracted from the soybean, is a valuable cattle feed, for which purpose it is mostly used in the United States; in Japan, however, the cake is used principally as a fertilizer. Ordinarily the cake is worth more, per unit of soybean processed, than the oil.

Production

In Japan soybeans (as a crop) are grown extensively for green manure as well as for the soybeans (as a product). The principal center of production of the soybeans is the island of Hokkaido. The output in Japan in 1939 was 14 million bushels, which was higher than in any previous year since 1930. This increase in production, as well as the high level of imports into Japan in 1938 (30 million bushels, the highest of record), apparently resulted from Japan's increased requirements for food, oil, and fertilizer occasioned by the war. The soybeans grown in Japan are better adapted for use as food than those imported from Manchuria and Korea; consequently the domestic output is used for food and the imports for processing for oil and oil cake.^{2/}

The value of the production of soybean oil in Japan has steadily advanced, increasing from 9 million yen in 1931 to 22 million yen in 1938. In the latter year the value of the soybean oil represented about 30 percent of the total value of all vegetable oil produced in Japan.^{3/}

Soybean cake is by far the most important of the oil cakes produced in Japan. Since Japan is on an import basis with respect to fertilizer, the cake is very important in the Japanese economy. According to official statistics of the Japanese fertilizer industry for 1928-32, the production of fertilizer and fertilizer material was valued at 196 million yen, imports of fertilizers and materials at 128 million yen, and exports at 20 million yen.^{4/}

^{1/} According to a recent announcement (Soybean Digest, April 1945), one of the large vegetable oil firms has placed on the market a patented high-grade drying oil made from soybean oil.

^{2/} Dr. W. J. Morse, Soybean Digest, January 1945, p. 6.

^{3/} Japan Yearbook, 1936 and 1940-41.

^{4/} Japan-Manchoukuo Yearbook, 1937, pp. 364-5.

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Imports.

The soybean is the principal oilseed imported into Japan. Up to 1937 Japanese imports of soybeans averaged 26 million bushels annually, in 1938 they amounted to 30 million bushels. Most of these imports originated in Manchuria. Japanese imports from that country (including Kwantung) increased from an average of 18 million bushels during 1928-32 to 25 million bushels in 1938. The only other important source was Korea, which supplied about 30 percent of the total Japanese imports of soybeans up to 1933, but only about 20 percent during the period 1934-38 (see table 2).

The value of the imports of soybeans increased from 57 million yen in 1933 to 102 million yen in 1938. The ratio of the value of Japanese imports of soybeans to the total value of all oilseeds imported was 74 percent for the period 1928-32 and 64 percent for the period 1933-36.

Post-war problems.

Soybeans have been very important in Japan's economy, not only for oil and cake but also for direct use as food. Japan proper is on a deficit basis with respect to both oils and fertilizers. Its imported soybeans have been one of its principal sources of both of these products, while its own soybean crop has been used principally for food. Japan has been unable to devote sufficient land to soybeans to produce its requirements for oil and cake. Any increase in the area devoted to soybeans would reduce the area devoted to other essential crops unless it occurred on land previously uncultivated, say in Hokkaido, or on land formerly devoted to purposes for which the need no longer existed, because of changed conditions (possible examples might be the production of mulberry leaves for silk production, or vegetable seeds, flower seeds, or lily bulbs for export). Actually there appears to be little chance of any substantial increase in soybean production in Japan; if Japan is to have sufficient soybeans to supply its needs, it will have to continue to import most of them; and its most readily available source of imports will undoubtedly continue to be Manchuria and, to a lesser extent, Korea. If Japan should be able to increase its imports of other oilseeds, or of oils and fertilizers, however, its needs for soybeans would be correspondingly reduced.

(See also the studies in this series entitled "Fats, Oils, and Oil-bearing Materials," "Potash," "Phosphate Rock," and "Nitrogen.")

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The phosphate rock obtained from Kita Daito Jima is not a phosphorite ore, but an iron and aluminum phosphate. This ore cannot be used to produce superphosphate, but is used for the production of phosphorus, ferro-phosphorus, and a fertilizer material called "Rinsen Alumina," which is essentially aluminum phosphate.

Phosphate rock is consumed in Japan principally for the manufacture of superphosphate fertilizers. Smaller quantities are used in the production of phosphorus, ferrophosphorus, and ammonium and aluminum phosphates. Only production data for the output of superphosphates and of phosphorus in Japan are available. (See table 3.)

Table 3.- Japan proper and Karafuto: Production of superphosphates and phosphorus, 1928-38

Year	Superphosphates			Phosphorus			Total
	Calculated:			Calculated:			Calculated
	consumption:			consumption:			consumption
	of			of			of
	phosphate			phosphate			phosphate
	Quantity:	Value	rock 1/	Quantity:	Value	rock 2/	rock 2/
	Metric tons	1,000 yen	Metric tons	Metric tons	1,000 yen	Metric tons	Metric tons
1928 ---	789,452	-	653,038	-	-	-	653,038
1929 ---	969,676	34,697	639,986	493	518	3,599	643,585
1930 ---	862,378	35,550	569,169	426	424	3,110	572,279
1931 ---	870,398	26,133	574,463	478	368	3,489	577,952
1932 ---	991,027	27,366	654,070	469	405	3,424	657,502
Average:							
1928-32	936,586	-	618,147	-	-	-	618,147
1933 ---	1,172,637	33,389	773,840	1,344	891	9,811	783,751
1934 ---	1,086,840	31,870	717,314	1,245	1,172	9,069	726,403
1935 ---	1,314,477	41,027	867,555	1,549	1,318	11,308	878,863
1936 ---	1,414,067	46,692	933,284	1,622	1,379	11,841	945,125
1937 ---	1,568,932	59,213	1,035,495	1,454	1,432	10,614	1,046,109
Average:							
1933-37	1,311,391	42,438	865,518	1,443	1,238	10,533	876,050
1938 ---	1,258,262	51,983	830,453	1,139	1,428	8,315	838,768

1/ Calculated on the basis of 0.66 metric tons of phosphate rock (containing 75 percent tricalcium phosphate) required to produce 1 metric ton of superphosphates.

2/ Calculated on the basis of 7.3 metric tons of phosphate rock (containing 75 percent tricalcium phosphate) required to produce 1 metric ton of phosphorus.

3/ Does not include small amounts consumed in making other phosphate products. (See Description and uses.)

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Japanese production of superphosphates, which consumed about 87 percent of the imports of phosphate rock during the 5-year period 1933-37, increased from 870,000 metric tons valued at 26 million yen in 1931 to 1,569,000 metric tons valued at 59 million yen in 1937. In 1938 the production declined in quantity to 1,258,000 metric tons, but increased in value to 62 million yen. Although there was a considerable increase in exports of superphosphates (amounting to roughly 90,000 metric tons a year) during the 5 years 1933-37 compared to the previous 5 years, production for the Japanese domestic market increased about one-third during these same periods.

Production of superphosphates reportedly was carried on in 15 prefectures during 1938. The prefectures of Tokyo, with a production of 259,000 tons, Hyogo, with 253,000 tons, and Osaka, with 205,000 tons, accounted for about 57 percent of the total production. There were 37 factories producing superphosphates during 1938. Approximately 55 percent of the superphosphate production is consumed as such and the balance of 45 percent is consumed in mixed fertilizers. The amount of double or triple superphosphate produced is not known, but it is probably between 1 and 2 percent of total production of superphosphates.

Imports.

Production in Japan of phosphorus, which consumed only 1 percent of phosphate rock imports during the 5 years 1932-37, increased from 426 metric tons valued at 424,000 yen in 1930 to 1,622 metric tons valued at 1.38 million yen in 1936. Japanese phosphorus production declined after 1936 to 1,454 metric tons in 1937 and to 1,139 metric tons in 1938. Apparently most of the Japanese production of phosphorus was consumed in the manufacture of matches. The extensive use of phosphorus as a military agent has not been reported.

About 12 percent of Japanese imports of phosphate rock during 1933-37, or between 115,000 to 120,000 metric tons, were consumed in the manufacture of products other than superphosphates and phosphorus.

Import statistics of phosphate rock contained in the official Monthly and Annual Returns of Foreign Trade of Japan are somewhat lower than those obtained from the Phosphate Rock Export Association. Japanese official import statistics showed an average of 86,365 metric tons, valued at 2.1 million yen, from the Mandated Islands during the 5-year period 1933-37 as compared to 92,716 metric tons from the Association's figures for the same years (see table 4). Imports of phosphate rock into Japan from foreign sources as given in official trade returns averaged 514,823 metric tons annually, valued at 11.15 million yen, during the period 1933-37, and 779,208 metric tons, valued at 21 million yen annually, in the 5-year period 1933-37, as compared to the Phosphate Association's statistics of 551,591 and 835,445 metric tons respectively during the same periods. The statistics of the Phosphate Rock Export Association are probably more reliable than the official Japanese returns. The three principal foreign sources in the decade preceding the present war were the United States, Egypt, and the Straits Settlements (see table 5).

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Imports of phosphate rock into Japan are largely (probably 90 percent or more) for agricultural purposes. The 40-percent increase in imports during 1933-37 over the previous 5 years was principally due to larger consumption of superphosphates in Japan proper and to increased exports of superphosphates to Korea and Formosa.

There have been no imports of superphosphates into Japan proper for many years. These imports, which were substantial in earlier years, ceased in 1913.

Table 4.- Phosphate rock: Imports into Japan proper from the Mandated Islands, 1928-39, with averages 1928-32 and 1933-37

(In metric tons)							
Year	Saipan	Rota	Fais	Peleliu	Angaur	Tokobai	Total
1928	-	-	-	-	68,546	-	68,546
1929	-	-	-	-	63,638	-	63,638
1930	-	-	-	-	57,488	-	57,488
1931	-	-	-	-	45,400	-	45,400
1932	-	-	-	-	55,219	-	55,219
Average 1928-32	-	-	-	-	58,058	-	58,058
1933	-	-	-	-	73,253	-	73,253
1934	-	-	-	-	64,807	-	64,807
1935	-	-	-	5,537	78,112	-	83,649
1936	-	-	-	22,148	89,226	-	111,374
1937	-	9,824	-	28,006	91,259	1,407	130,496
Average 1933-37	-	1,965	-	11,138	79,331	281	92,716
1938	5,542	49,714	14,222	28,566	104,186	2,810	205,787
1939	20,679	43,539	43,821	26,303	143,420	4,269	282,031

1/ Source of data--Hiryo Nenkan 1940, page (statistical) 58.
 2/ Includes 747 metric tons imported from Grimes Island.

Source: Phosphate Rock Export Association, London and New York.

Table 5.- Phosphate rock: Imports into Japan proper from foreign sources (excludes the Mandated Islands), by principal countries, 1928-39, with averages 1928-32 and 1933-37

(In metric tons)

Year	: United States	: Egypt	: Straits Settlements	: Society Islands	: Gilbert and Ellice Is.	: Other 1/	: Total
1928 -----	: 177,332	: 112,496	: 117,863	: 55,019	: -	: 20,339	: 483,049
1929 -----	: 244,603	: 137,911	: 122,435	: 62,233	: -	: 39,912	: 607,094
1930 -----	: 288,331	: 160,076	: 98,558	: 49,787	: -	: 31,313	: 628,065
1931 -----	: 220,822	: 106,720	: 66,857	: 37,594	: -	: 14,672	: 446,665
1932 -----	: 141,429	: 231,974	: 86,873	: 46,739	: 29,974	: 56,094	: 593,980
Av. 1928-32:	: 214,503	: 149,835	: 98,517	: 50,274	: 5,995	: 32,466	: 521,590
1933 -----	: 157,279	: 285,621	: 96,525	: 45,723	: 36,476	: 93,215	: 714,839
1934 -----	: 221,334	: 272,981	: 107,278	: 81,026	: 49,174	: 16,562	: 748,356
1935 -----	: 241,573	: 263,145	: 118,545	: 111,709	: 38,456	: 25,750	: 799,178
1936 -----	: 296,983	: 303,685	: 132,842	: 105,156	: 41,199	: 27,109	: 806,974
1937 -----	: 271,427	: 320,315	: 128,473	: 137,505	: 77,419	: 74,738	: 1,009,877
Av. 1933-37:	: 237,719	: 288,749	: 116,733	: 96,224	: 48,545	: 47,475	: 835,445
1938 -----	: 177,462	: 179,440	: 99,624	: 72,847	: 31,140	: 20,016	: 580,529
1939 -----	: 225,967	: 230,450	: 136,723	: 146,710	: 49,632	: 25,300	: 814,782

1/ Principally Morocco and Tunisia.

Source: Phosphate Rock Export Association, London and New York.

Exports.

Exports of phosphate rock from Japan proper are not reported in official statistics. There may have been small reexports of phosphate rock to Korea and Formosa for the manufacture of superphosphates but official statistics of Japan, Korea, and Formosa do not indicate any. There were, however, fairly large quantities of superphosphate exported to Korea, Formosa, and other countries (see table 6).

The elimination of exports of superphosphate from Japan would reduce requirements for phosphate rock imports by 10-15 percent based on the supply situation existing in the period 1933-37.

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Table 7.- Superphosphates: Consumption in Japan proper
1930-38

Year	Superphosphates	Phosphate rock equivalent of superphosphates consumption ^{1/}
1930 -----	922,064	608,562
1931 -----	808,109	533,352
1932 -----	960,497	633,928
Average		
1930-32 -----	-	591,947
1933 -----	1,009,722	666,417
1934 -----	1,004,590	663,029
1935 -----	1,150,751	759,628
1936 -----	1,242,400	819,984
1937 -----	1,379,935	910,757
Average		
1933-37 -----		763,963
1938 -----	1,036,768	684,480
1939 -----		

^{1/} Calculated on the basis of 0.66 ton. of phosphate rock per 1 ton of superphosphates.

Source: Keizai Nenkan 1941, page 174.

Government control.

The distribution and prices of superphosphate fertilizers and of other commercial fertilizers is controlled by the Japanese Government. The original law, which provided for allocation of fertilizers to farmers through prefectures, towns, trade associations, and cooperatives was unsatisfactory and the responsibility of fixing fertilizer quotas and prices was transferred to semi-governmental controlled companies, the capital of which was equally subscribed by the Government and private industry, under the Japanese Fertilizer Administrative Law of April 8, 1940. The distribution and observance of fixed prices for superphosphates is under the control of the Superphosphate of Line Distribution Company. The established price of superphosphate during 1939 was 2.48 yen per 7½ kwan (57 to 70½ cents per 62 pounds.) In order to maintain its low-price policy, the Japanese Government subsidized the manufacture of superphosphate to the extent of 4.40 yen per metric ton during 1940.

In January 1939, it was reported that a Phosphate Rock Distribution Control Company would be formed, which would have monopolistic control over phosphate rock imports and would control the distribution to the various manufacturers of superphosphate and of other products from phosphate ore. The purpose of this company was to ensure smooth distribution and fair prices for phosphate rock. Subsequent information concerning this company is not available. Actually the Japanese Department of Finance controlled imports of phosphate rock by the issuance of exchange import licenses.

Wartime policy.

Prior to entering the war, Japan controlled sources of production of phosphate rock in Asia and the Pacific Islands, which were capable of producing 400,000-450,000 metric tons of ore annually. During 1942 the Japanese captured the Netherlands Indies, with a yearly phosphate rock production capacity of 30,000-50,000 metric tons, and Christmas Island, with an annual capacity of about 150,000 tons. This capacity and the production in French Indochina of about 35,000 tons annually, Chinese production in Kiangsu Province of about 8,000-10,000 tons, and deposits in Korea, Formosa, and Manchuria of unknown size increased supplies of phosphate rock available to between 575,000 and 675,000 tons, or about 60-70 percent of pre-war requirements.

As Allied Forces have since occupied or cut off from Japan most of the Pacific Islands, now only the Netherlands Indies, Christmas Island, the Loochoos or Loochoo Islands, and deposits on the mainland of China, with a total capacity of from 325,000 to 375,000 tons, are controlled by the Japanese. Transportation from all of these remaining sources to Japan proper, if available, is, of course, extremely hazardous.

Japan, even during the time of its most extensive conquest, only controlled productive capacity for 60-70 percent of its normal phosphate rock requirements and is now reduced to less than 35 percent of requirements. Thus even if the Japanese had large stocks of phosphate rock on hand before entering the war, it is highly probable that they are now completely exhausted.

Post-war problems.

Japan's post-war position relative to phosphate rock will be dependent on the economic policy adopted toward that nation. If the Japanese are only allowed to produce products from phosphate rock for their home consumption and the same quantities of self-supplied phosphatic fertilizers are available as in the pre-war period, about 765,000 metric tons of phosphate ore (based on a 75-percent content of tricalcium phosphate) will be required for the production of superphosphate fertilizers, about 5,000 tons for the production of phosphorus to be used in the manufacture of matches, and about 100,000 metric tons for the production of miscellaneous fertilizer

1/ Cook and Muro Islands, all captured by the Japanese, are not considered in this estimate as their productive capacity is not utilized to any great extent because of their proximity to combat operations in the Pacific.

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products, ferrophosphorus, and the various phosphates. All of this phosphate ore will have to be imported by Japan, unless, which is unlikely, it is allowed to retain the phosphate-producing islands of Kita Daito Jima and Rusa in the Loochoos or Loochoo Islands.

If Japan is allowed to export superphosphates, matches, and other phosphate products in pre-war quantities, a total of approximately 1 million tons of phosphate rock will have to be permitted to be imported. Also, if the Japanese merchant marine is destroyed or confiscated or other action taken, so that pre-war quantities of fish scrap and other waste phosphatic materials, which formerly supplied about 36 percent of the phosphorus-containing fertilizers consumed in Japan, are not available, additional quantities of phosphate rock will need to be imported to supply this deficiency. Because the amounts of phosphate rock used in making products other than fertilizers is, relatively, so small, it would be impractical to control the uses made of phosphate rock within Japan for such purposes by controlling imports.

The Japanese superphosphate industry is the second largest consumer of sulfuric acid in that country, the ammonium sulfate fertilizer producers being first. Production of superphosphate in Japan requires roughly 1 ton of 50° Baume sulfuric per ton of phosphate rock. Thus consumption of sulfuric acid of 50° Baume strength averaged 600,000-650,000 metric tons during the 5 years 1928-32 and 850,000-900,000 metric tons during the period 1933-37. During the latter 5-year period production of superphosphates used about 30 percent of the total Japanese output of sulfuric acid. Any reduction in the sulfuric acid production capacity in Japan proper would seriously affect their output of both fertilizer materials, ammonium sulfate, and superphosphates.

(See also the studies in this series entitled "Nitrogen," and "Potash.")